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1 ALBANY, N. Y. JANUARY 15, 1912

New York State Museum

JOHN M. CLARKE, Director
EPHRAIM PORTER FELT, State Entomologist

Museum Bulletin 156

ELM LEAF BEETLE AND WHITE-MARKED TUSSOCK MOTH

BY

EPHRAIM PORTER FELT D.Sc.

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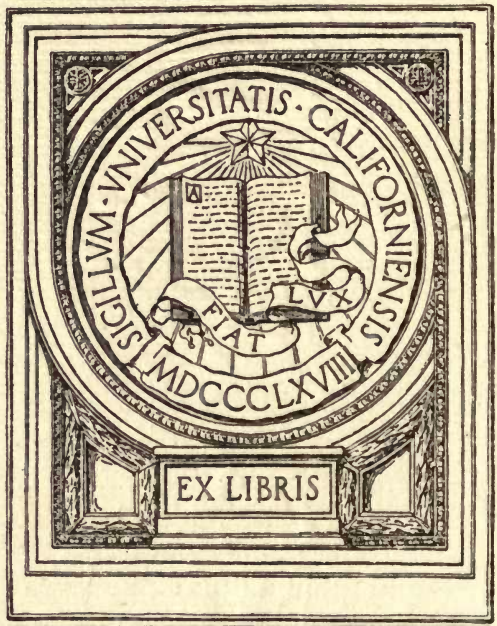


New York State Education Department
Science Division, April 4, 1912

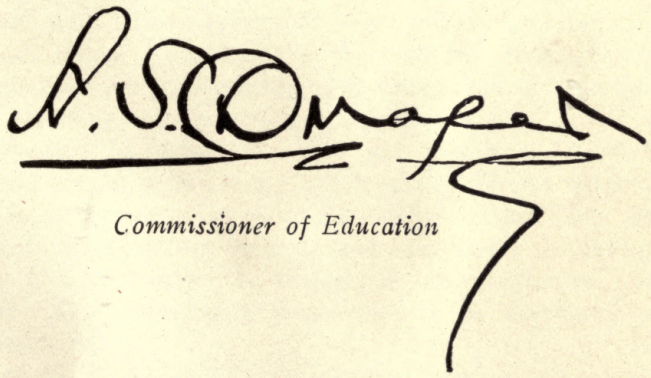
Hon. Andrew S. Draper LL.D.
Commissioner of Education

SIR: I have the honor to submit herewith a revision of our State Museum Bulletin 109 relating to the elm leaf beetle, the tussock moth and their depredations upon our shade trees. The demand for information on these insect pests is large and the last edition of the bulletin is now exhausted. I therefore recommend this manuscript for publication.

Very respectfully
JOHN M. CLARKE
Director

STATE OF NEW YORK
EDUCATION DEPARTMENT
COMMISSIONER'S ROOM

Approved for publication this 9th day of April 1912



Commissioner of Education

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JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

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ELM LEAF BEETLE AND WHITE-MARKED TUSSOCK MOTH

BY

EPHRAIM PORTER FELT D. Sc.

The elm leaf beetle and the white-marked tussock moth must be ranked among the most important leaf feeders affecting the shade trees of cities and villages in New York State. They have been responsible for widespread injury to thousands of trees in recent years, while earlier experience shows that we must reckon with these species if we would preserve the beauty of our trees. Experience in the past has demonstrated beyond all question the practicability of checking both of these leaf feeders by spraying, an operation which is not very costly if modern apparatus be employed. We are forced to conclude therefore that extensive injury by either of these pests must be attributed to indifference or culpable neglect rather than inability, despite the fact that many appear very eager to take up the warfare at a time when the ravages are most apparent and unfortunately when repressive measures can be employed to very little advantage.

There is a tendency on the part of many private individuals to attribute their woes to the neglect of adjacent shade trees on public streets, and conversely municipal authorities are prone to state that injury to public trees is due to the pests swarming thereto from neglected private grounds. The facts of the case are that both of these insects are very local in habit. This is a

necessity in the case of the tussock moth, because the female is wingless and as a consequence the species relies for dissemination on the very limited crawling powers of the caterpillar or upon being carried by other agencies. The elm leaf beetle, on the contrary, flies readily, but for some reason or other it is very local in its habits and not infrequently one may see magnificent trees infested with hordes of beetles and larvae, while within a block, sometimes within 50 feet, other elms may be practically free from the pest. These facts are of greatest importance to all interested in the welfare of shade trees, since they demonstrate beyond question the possibility of protecting the trees on our public streets, irrespective of what is done by private citizens, or conversely, the practicability of keeping the pest in check on private grounds, even though there is little or no repressive work upon those adjacent.

Elm leaf beetle

Galerucella luteola Müll

The ravages of this dangerous enemy to elms has been particularly severe in recent years. The damage has doubtless been accentuated in numerous instances by exceptionally dry weather and possibly by extremely low winter temperatures. These two factors afford no adequate explanation for the great increase in the number of injured trees, and particularly for the general destruction of the foliage so conspicuous in many communities in 1910 and 1911. It is very probable that the extension of electric car service and the more general use of automobiles have been of material service in disseminating a local and exceedingly prolific insect, since both of these vehicles usually traverse tree-lined streets and afford abundant opportunities for the collection and dissemination of the beetles and thus greatly increase the damage along favorite routes of travel.

This pest was so abundant and injurious from 1896 to 1899 in the cities of Albany and Troy as literally to compel some action or a very large proportion of the elms would have been destroyed. The insect made such headway in these cities that it ruined or killed about 3000 elms before the end of 1900, and it is more than probable that at least 1000 additional succumbed the following decade. The earlier spraying against this pest produced for the most part very satisfactory results, while the treatment in recent years has given indifferent returns in many

instances. An examination of conditions in several communities in the summer of 1911 forced us to the conclusion that most of the poor results following spraying were due to careless or slovenly work. It was a rather common occurrence to find the lower limbs fairly well sprayed, while the upper branches were almost untouched by the poison and, as a consequence, severely injured by the beetle.

Dead foliage in midsummer, a weakened or dying condition of the trees, and the vacant spaces formerly occupied by elms, are in most instances the direct result of injury by this pernicious beetle, though all conversant with the situation must admit that leaking gas and electricity have killed some trees in many communities. The number destroyed by these latter two agencies is small compared to those succumbing to insect depredations. Old age has been advanced by some as a reason for the death of many elms. This is hardly an adequate explanation, since many trees which have perished were comparatively young. Authentic records show that the American elm may live from 150 to 200 years. Under favorable conditions it should thrive for at least a century and in many instances for a century and a half. It is lamentable that so many magnificent elms, representing the growth of several generations, and in many instances occupying commanding positions and adding greatly to the beauty and value of the adjacent property, should be destroyed within a few years by an insect which may be controlled at a comparatively small expense.

Results of attack. Elms losing two crops of leaves a season for three or four years are invariably seriously affected and some at least may die. The injury is almost as severe if the first crop of leaves is destroyed so late that very little new foliage develops the latter part of the season. This condition was rather general with American elms in 1911 and may have resulted in part from the weakened condition of the trees, an outcome of earlier injuries.

Food plants. This leaf feeder displays a marked preference for the more tender foliage of the English and Scotch elms, though after the beetle has become abundant, it is frequently exceedingly destructive to the American elm. Its operations on this latter tree have been especially severe in the city of Watervliet and in villages in the upper Hudson valley.

Distribution. This pest has now attained an extensive distribution in this country, ranging from north of Salem, Mass., to Char-

lotte, N. C., and westward into Ohio and Kentucky. It occurs in most of the cities and villages in the Hudson valley, having made its way north to Glens Falls and Ticonderoga and along the Mohawk valley at least to Amsterdam. It has become well established at Elmira and Ithaca and has been known for some years in Oswego, though it does not appear to have been particularly destructive in that city. There is no record known to us of this species occurring in Utica, Syracuse, Rochester or Buffalo, though it is rather surprising that it has not already become established in all of these cities.

Description. The skeletonized brown appearance of the foliage in midsummer is very characteristic of the work of this pest, particularly in the eastern cities and villages of the State. The irregular, oval holes about one-quarter of an inch in diameter, eaten by the beetles in early spring, are another indication of the work of this species.

The parent beetle may be recognized by reference to the colored illustration [pl. 1, fig. 5, 6]. It is about one-quarter of an inch long, with the head, thorax and margin of the wing covers a reddish yellow. The coal-black eyes and median spot of the same color on the head are prominent. The thorax is marked with a dorsal black spot of variable shape and with a pair of lateral ovoid ones. The median black line on the wing covers is widely separated from lateral stripes of the same color by greenish yellow. The wing covers are minutely and irregularly punctured, bear a fine pubescence and at the base of each there is an elongated, black spot in the middle of the greenish yellow stripe. These markings are fairly constant in the beetle, though the color is quite variable during life and changes more or less after death. Many of the insects emerging from winter quarters have the yellowish stripes of the wing covers nearly obliterated by black.

The orange-yellow eggs [pl. 1, fig. 1] are usually deposited in irregular rows side by side, forming clusters of from three to twenty-six or more on the underside of the leaf. Each egg is somewhat fusiform, attached vertically by its larger end and with the free extremity tapering to a paler rounded point.

The recently hatched grub [pl. 1, fig. 2] is about one-twentieth of an inch long with the head, thoracic shield, numerous tubercles, hairs and legs jet-black. The skin is dark yellow but the tubercles are so large and the hairs so prominent that the prevailing color of the grub at this stage is nearly black. An increase

in size, following molts, is accompanied by the stiff hairs becoming less conspicuous and the yellow more prominent, till the grub becomes full grown [pl. 1, fig. 3]. It is then about one-half of an inch long, more flattened than in the earlier stages, with a broad, yellowish stripe down the middle of the back and with a narrower stripe of the same color on each side, these being separated by broad, dark bands thickly set with tubercles bearing short, dark colored hairs. The dorsal yellow stripe is broken on each side by a subdorsal row of black tubercles which decrease in size posteriorly. The lateral yellow stripe includes a row of prominent tubercles with dark tips bearing hairs of the same color. The under surface is yellowish.

The pupa [pl. 1, fig. 4] is a bright orange-yellow, about one-fifth of an inch long and with a very convex dorsal surface which bears transverse rows of stout, inconspicuous hairs.

Life history. The transformations of this insect are so rapid and so greatly influenced by local conditions that a man must know what to expect or he will accomplish very little in fighting the pest, because a substance effective against the beetles or grubs may not kill the pupae and, after the larvae have begun to descend, may be of no value. The beetles winter in attics, sheds, belfries and other shelters. They emerge with the advent of warm weather and may then be found on the walks during the sunny portion of the day or at the windows of houses, trying to escape. The last of April or early in May, with the appearance of the foliage, the beetles fly to the elms and eat irregular holes in the leaves. Some time is occupied in feeding before the deposition of eggs, the latter may continue four and possibly five or six weeks. The prolific beetles consume a large amount of foliage during this time, depositing clusters of from three to twenty-six or more eggs every day or two. Over half the total number of eggs may be laid at the height of the season within about twelve days; in 1898, from June 12th to 23d. A female may produce over six hundred eggs.

The young grubs appear early in June or about five or six days after the eggs have been deposited later in the season. They feed on the under surface of the leaf, producing the familiar skeletonization [pl. 1, fig. 7] which is caused by their eating the softer underpart, leaving the veins and the upper epidermis practically untouched. The results of their feeding are so marked that it is easy to detect the presence of the grubs by the

semitransparent patches in the foliage. These latter soon dry and turn brown.

There are two and occasionally three generations of this destructive insect in the latitude of Albany, the number depending to a considerable extent upon the availability of suitable food. The grubs complete their growth in from fifteen to twenty days, descending limbs and trunk to a great extent in search of some shelter under which to pupate. Seven days are spent in this latter state in warm July weather, while in September it is extended to twelve and in October to twenty-four days. The grubs of the first brood usually forsake the trees in Albany by the last of June or early in July, and beetles belonging to the second generation may begin depositing eggs about the middle of July, and from then to late in autumn it is generally possible to find this insect in all stages in some part of Albany. The beetles of the second brood are naturally attracted to fresh foliage and consequently more eggs are usually deposited on trees which have been defoliated earlier in the season than upon others.

Badly infested trees are therefore very likely to lose two crops of leaves in a season and may possibly have their third seriously marred by this pest. The second brood of grubs completes its growth about the middle of August, beetles appearing the latter part of the month, and if there is an abundant supply of fresh leaves, a third generation may appear in considerable numbers. This last brood more frequently occurs in near-by trees which have not been severely injured earlier in the season.

Natural enemies. This leaf feeder is subject to attack by a number of natural enemies, most of which, however, are of comparatively little importance in keeping it in check. The common garden toad will devour many beetles, and the much despised English sparrow also feeds upon these insects to some extent. Several predaceous insects prey upon this pest to a certain degree.

Preventive measures. There are measures of considerable value in the prevention of insect depredations, and there is no reason why such should not be applied to the shade tree problem. It is a mistake to have half to three-fourths of all the shade trees in a city or village one species, especially if mostly on contiguous streets. This is true of many localities where the elm leaf beetle has caused very serious injury during the last few years. The American elm and sugar maple, both

deservedly favorites for shade and park trees, may well give way in part at least to other desirable species, such as the Norway maple, an excellent tree in many ways and practically free from the insect pests so injurious to the sugar and the white or silver maple. The last named has been extensively used in many localities, and though brittle and liable to injury by wind and ice, usually keeps in excellent condition for a number of years. The red maple is also a valuable tree. The American basswood or linden, the horsechestnut, the European plane tree or buttonwood, the American ash and oaks, especially the pin oak, red oak and scarlet oak should be set more freely. The Ailanthus (pistillate trees) and the Carolina poplar, though possessing serious drawbacks, are desirable under certain conditions. This diversified planting would admit the use of one species on a street, and if adjacent streets were set with different varieties, such an arrangement would go far toward reducing the possibility of extended outbreaks by injurious insects or fungous diseases.

The proper care of trees, including judicious selection so as to secure the best adaptation to local conditions, is an important factor in forestalling insect ravages. Trees in full vigor are better able to sustain injury and are usually less troubled by insects than those in a debilitated condition. Certain progressive communities have already recognized this need and have met it in a more or less satisfactory manner. The city of Newark, N. J., with a population of 347,469, expends for tree work (which latter is separate from park work) about $27,000 a year, $6000 of this being for pruning, $6000 for spraying and $15,000 for setting out new trees, maintenance etc. East Orange, N. J., with a population of only 34,371, expended in 1909 over $10,000 through its shade tree commission, $1200 of this being a special appropriation for spraying elms. The city of Buffalo has recently placed the care of its trees in the hands of a forester and there is no reason why other communities should not adopt equally comprehensive measures. Spraying alone is not sufficient. There should be wise planting, judicious pruning and liberal fertilization whenever necessary.

Remedial measures. The secret in controlling this insect lies in understanding thoroughly its life history and appreciating the vulnerable points. A thorough spraying with a poison early in the spring, when the leaves are half out or larger, is most

effective in preventing breeding, as the beetles are destroyed before they can deposit many eggs. Arsenate of lead is by far the best poison and should be used at the rate of four pounds (15 per cent arsenic oxid) to fifty gallons of water. Fortunately the beetles are rather local in habit and as a consequence individual trees or groups of trees may be protected to a very large extent even if there are neglected ones in the near vicinity. The local spread of this pest is slow and this should be taken advantage of to the greatest possible extent by keeping the insect in control wherever it occurs, even though the infestation be a small one and the present injury of comparatively little importance. It is a mistake on the part of local authorities to wait till this enemy of the elms has become well established and destructive before repressive measures are undertaken.

The grubs feed almost exclusively on the under surface of the leaf, rarely occurring upon its upper side. The first injury is usually on the upper more tender leaves, hence there is great need of spraying the tops of the trees, and in order to kill the destructive grubs it is essential that the poison be thrown on the underside of the foliage. Spraying with an arsenical poison for the destruction of grubs is satisfactory only when the application is early, as it is hardly advisable to spray for this insect when the grubs are nearly full grown, since they are liable to desert the tree even when slightly underfed and complete their transformations, rather than to eat distasteful foliage.

The ideal spray for this pest is a fine mist applied to the under side of all the leaves. It is impossible to throw such a spray any distance, and owing to the great height of most elms, such treatment is impractical. A moderately coarse spray which can be thrown 25 to 40 feet has been usually employed in connection with ladders or the use of a high tower. The latter is practical only where the streets are fairly level. The recent development in the use of a solid stream and pressures of between 200 and 300 pounds for gipsy moth work has greatly reduced the cost of applications in woodlands, and the system is now being applied to shade trees with a corresponding saving in time and expense. This method necessitates the use of more poison, there is increased dripping and the throwing of the spray upon the foliage is not so readily controlled. These are grave though not insurmountable objections, and for the present we are inclined to favor a moderately coarse spray with the use of ladders or a tower as the most practical method of spraying shade trees.

Communities usually fail to realize that in the elm leaf beetle we are dealing with an insect extremely sensitive to poison and one which will feed upon sprayed leaves only when no others are available. Its senses are so keen that it can detect poison hardly visible with a powerful hand lens. Under such conditions one may readily see how easy it is to secure indifferent results. Spraying trees is a disagreeable, hazardous occupation, and in order to secure the best returns, it is necessary to make the compensation such as to result in a keen competition for the position of nozzleman. The application of business principles would justify larger municipalities placing this work in the hands of one who understood at least the rudiments involved (a skilled landscape gardener or forester would be even better) and giving him authority to insist upon any reasonable standards in methods and operation. Such a person could reasonably be expected, if provided with sufficient funds, to keep the foliage of elms practically intact throughout the season, even in sections where the elm leaf beetle was excessively abundant or upon trees adjacent to those badly injured by the pest. Many trees were badly injured last year because there was so much difficulty in securing men who would do thorough work, a prime essential in an undertaking of this kind.

The effective spraying season extends from early to middle May till nearly the latter part of June, a total of approximately six weeks. Making allowances for interruptions by rain, we can hardly expect more than thirty full working days during this period. A power spraying outfit of the usual type and provided with two lines of hose can spray thoroughly, perhaps fifty trees a day or a maximum of 1500 during the season as restricted above, much depending upon the size and location of the trees as well as the efficiency of the men in charge.

The cost of thorough spraying is not excessive. It may be estimated at about 50 cents a tree or only 10–20 cents a tree if all the work be done from the ground with a high power outfit, in each case making no allowance for the cost of apparatus. A power spraying outfit adapted to shade tree work can hardly be obtained for less than $275 to $500, and in case of the high pressure outfits, may easily amount to more than double the latter sum. There should be plenty of power, an abundance of hose and good ladders unless it is planned to do all the work from the ground. This work can be done with a powerful hand pump at a greater cost for operation though the initial expense

($30—$50) is much less. It is extremely desirable, where conditions permit, for a community to provide not only for the spraying of the street trees, but also to arrange for the care of those on private grounds at a nominal cost.

The full-grown larvae crawl down the trunks in great numbers and the golden yellow pupae may be found in abundance in crevices in the bark and on the ground about the tree. A good proportion of the insects can be forced to take refuge on the ground by scraping off the rough bark, thus depriving them of shelters upon the tree. Large numbers can then be killed when assembled about the base of the tree by spraying them with a contact insecticide such as kerosene emulsion, whale oil soap solution or even by pouring boiling water on them. The grubs should be destroyed in the manner indicated every five days so long as the pests are seen in numbers, in order to secure the best results. This method of fighting the pest is advisable only when it is impossible to employ the more satisfactory arsenical sprays. Bands of tar, sticky fly paper, cotton batting, etc., while they do no harm, can not be considered of much value in keeping the elm leaf beetle under control. The relatively few grubs caught on a sticky band are but a drop in the bucket compared with the masses which complete their transformations either above or below. It is worse than useless to attempt to control this or any other insect by boring a hole in the trunk of a tree and inserting therein compounds of any nature. The tree is weakened and unless the chemical be powerful enough to kill it, the insects are not affected.

White-marked tussock moth.

Hemerocampa leucostigma Abb. & Sm.

This insect, preeminently a pest on city and village trees, occasionally proves a veritable scourge over considerable areas. Some cities appear to be more afflicted in this way than others. The summer of 1906 was marked by extensive depredations in a number of cities and villages throughout the State, thus duplicating the experience of 1898. It will therefore be seen that serious injuries by this caterpillar are more or less periodic. This is to be explained by the fact that the species has a number of natural enemies which assist materially in keeping it under control. The destructive outbreaks are examples of what might occur annually were there no parasites to check the work of this

voracious leaf feeder. The cause of this native species thriving so greatly in cities and villages during recent years is explained by the abundance of the English sparrow. This bird will not eat the caterpillars and drives away many of the native forms which, in earlier days, were of great service in devouring these hairy pests.

Description. The full-grown caterpillar is really a beautiful object. It has a coral-red head, a pair of long, black plumes just over it, a single one at the opposite extremity of the body, four delicate yellowish or white, brushlike tufts on its back and just behind them, separated only by a segment, two small retractile red elevations. There is a broad, black band broken only by tubercles and tufts along the back and bordered by yellowish stripes. Each side is dark gray except for the yellowish tubercles. The breathing tubes or spiracles are in a lateral black line and below this the caterpillar is yellow, the legs usually being paler [pl. 2, fig. 4]. The very young caterpillar is pale yellowish or whitish with long, irregular hairs. It increases in size, casts its skin from time to time and assumes one after another the characteristics of the full-grown larva.

The thin cocoons spun in the crevices of the bark [pl. 2, fig. 6] have the long hairs of the caterpillar interwoven and within this shelter the larva transforms to a yellowish white pupa more or less shaded with dark brown or black [pl. 2, fig. 7].

The sexes differ strikingly as is shown on plate 2, figures 1 and 2. The male is a beautiful moth with large feathery antennae, tufted legs, and with the wings and body delicately marked with several shades of gray or grayish white. The female, on the other hand, is a nearly uniform gray with simple antennae and but rudimentary wings.

The eggs, usually over three hundred, are deposited on the empty cocoon, under a conspicuous white mass of frothy matter about one-half of an inch in diameter [pl. 2, fig. 3]. This soon hardens and forms a very effective protection. The egg masses [pl. 7, 8] are easily removed and a tree thoroughly cleared thereof can become infested again only by caterpillars crawling from adjacent trees or being carried thereto. The individual egg is nearly spheric, about one-twenty-fifth of an inch in diameter, white or yellowish white and with a light brown spot surrounded by a ring of the same color.

Life history and habits. This insect winters in the conspicuous egg masses described above, the young appearing about

the latter part of May in this latitude. They feed at first on the more tender lower epidermis of the leaf and soon devour all but the principal veins. The small caterpillars frequently hang by a silken thread and continued jarring may cause many to drop to the ground. Feeding and growth occupy a month or more, pupation occurring the latter part of June or early in July. There is some deviation from this, as a few individuals spin up early and some caterpillars linger till numerous egg clusters indicate that most of the insects have completed the round of life. The pupal stage occupies from ten to fifteen days. The wingless female appears at the end of this period, crawls on her cocoon and shortly deposits eggs as described. There is normally but one generation annually in Albany and other inland cities, while in New York City and vicinity and in Boston, Mass., there are two broods and at Washington, D. C., there are three generations each year as stated by Doctor Howard.

The young caterpillars drop from the tree readily, suspend themselves by silken threads and then may be blown or carried considerable distances. The full-grown caterpillars desert the trees and wander considerably. This is particularly true of the larger ones which almost invariably produce female moths. The cocoons are spun very generally on the trunks or on the underside of the larger branches.

Food plants. This leaf feeder exhibits a marked preference in cities for the linden and horse-chestnut, while it feeds readily on elms and maples. It has also been recorded on a number of other trees.

Natural enemies. This species has a number of natural enemies. Its comparative rarity in the country shows that our native birds must be very efficient natural checks upon this insect. Mr E. H. Forbush states that forty-seven species of native birds feed on hairy caterpillars, most of which would probably take this leaf feeder. The robin, Baltimore oriole and cuckoo are among the more valuable in this respect.

Parasitic insects are also very efficient checks. This species is subject to attack by some twenty-one primary parasites and these in turn may become the prey of fourteen hyperparasites.

Remedies. A simple and very satisfactory method of controlling this insect is the gathering and destroying of egg masses. Several cities and villages in New York State have employed children in this work by offering a small bounty and a system of prizes. The result has been that a large number of egg masses

were secured and destroyed at a comparatively slight cost. The defect in this method is that it is more or less irregular in operation and is usually resorted to only after serious injury to the trees has aroused public opinion. There is no doubt as to the effectiveness of collecting egg masses and in not a few instances it may prove the cheapest method of keeping this pest in check. It would seem better for the welfare of the trees to make some provision for the systematic collection of egg masses from year to year from all the trees, even though the cost be somewhat greater.

The collection of egg masses should be supplemented, if uncleaned trees are in the vicinity, by banding the trunks at the time the caterpillars begin to crawl, with some material which will prevent the ascent of straggling larvae. A very simple method is to take a band of cotton batting some six or eight inches wide, wrap it around the tree, tie a string about its middle and then turn the upper edge down over the string. Tree tanglefoot, a preparation made by the same company that manufactures tanglefoot fly paper, has been used very extensively on trees about Boston. It is very adhesive, remains sticky for a considerable time and does not injure the bark of older trees at least.

The tussock moth caterpillar succumbs readily to arsenical poisons and where the trees are infested or are likely to be attacked by more than one leaf feeder, as is true in the Hudson valley, spraying is perhaps the best method of protecting the trees. One of the best poisons for this purpose, particularly in sections infested by the elm leaf beetle, is arsenate of lead, (15 per cent arsenic oxid), used at the rate of four pounds to fifty gallons of water.

EXPLANATION OF PLATES

Plate 1

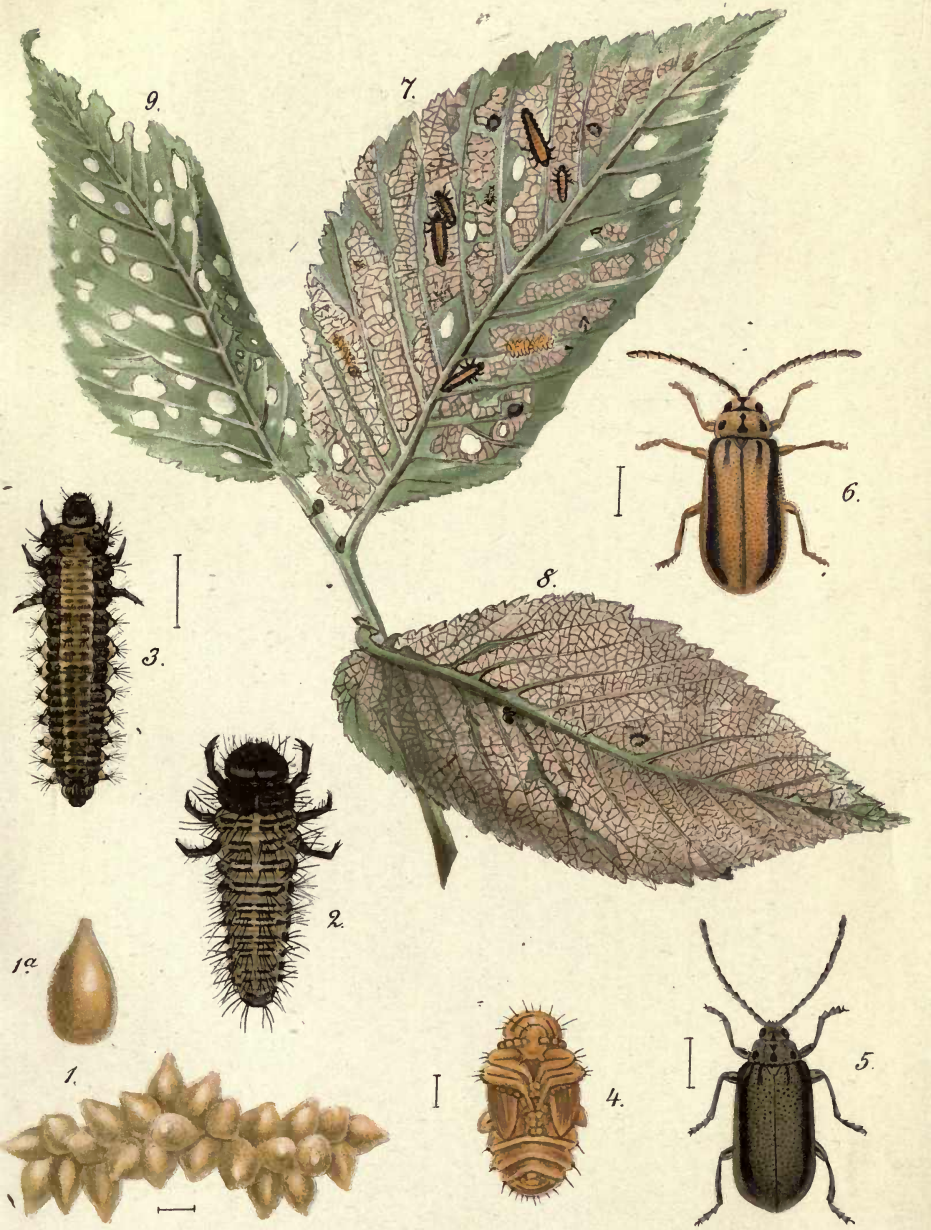
Executed from nature, under the author's direction, by L. H. Joutel of New York City, and reproduced from the 5th report of the Commissioners of Fisheries, Game and Forests through the courtesy of the commissioners

Elm leaf beetle

Galerucella luteola Müll.

1 Cluster of eggs, much enlarged
1*a* Side view of single egg, still more enlarged
2 Recently hatched larva or grub, much enlarged
3 Full-grown larva or grub, much enlarged
4 Pupa, much enlarged
5 Overwintered beetle, much enlarged
6 Fresh, brightly colored beetle much enlarged
7 Leaf showing eating of larvae or grubs and a few holes eaten by beetles, eggs in clusters, cast larval skins and full-grown larvae, natural size
8 Leaf skeletonized by grubs
9 Leaf eaten by beetles

PLATE 1



L. H. Joutel, 1900.

ELM LEAF BEETLE

(Reprint from 5th report of commissioners of fisheries, game and forests)

Plate 2

Executed from nature by L. H. Joutel

White-marked tussock moth

Hemerocampa leucostigma Abb. & Sm.

1 Male moth at rest on trunk
2 Female laying eggs upon her cocoon
3 Egg masses on cocoons
4 A full-grown caterpillar resting on a twig
5 Cast skins of caterpillars
6 Cocoons massed on trunk
7 Pupa of female within cocoon
8 Twigs girdled by caterpillars
8*a* Twig broken off at point of girdling
The foliage shows the effects of this caterpillar's work

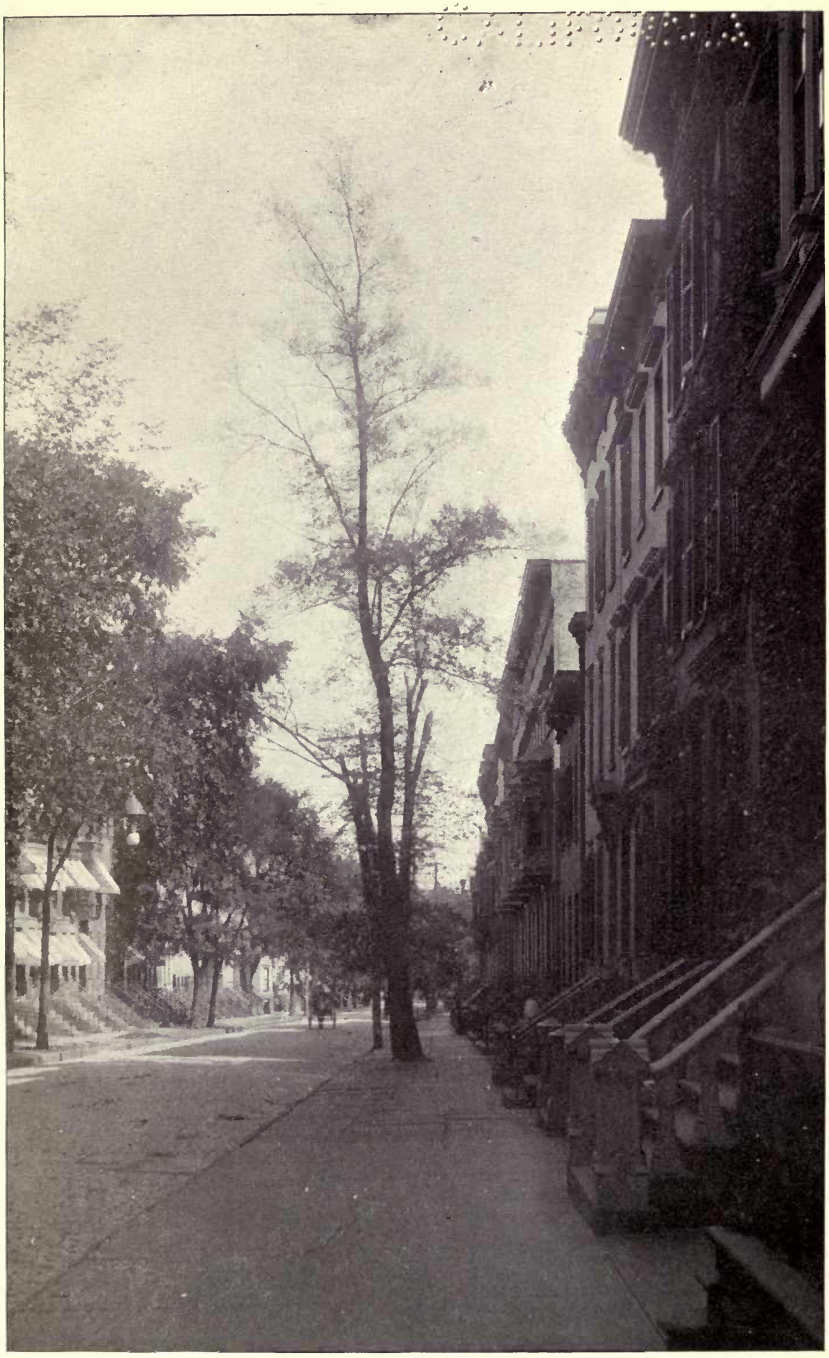
L. H. Joutel, 1906.

WHITE MARKED TUSSOCK MOTH

Plate 3

A magnificent English elm nearly defoliated by the elm leaf beetle, Galerucella luteola Müll. Lancaster street, Albany. Photo August 1906.

Plate 3



Albany, Aug. 1906

Work of elm leaf beetle on Lancaster street

Plate 4

Row of English elms on South Hawk street, Albany, nearly ruined by the work of the elm leaf beetle, Galerucella luteola Müll. Photo August 1906. These nine trees were, in 1898, in about the same condition as the one illustrated on plate 3.

Plate 4

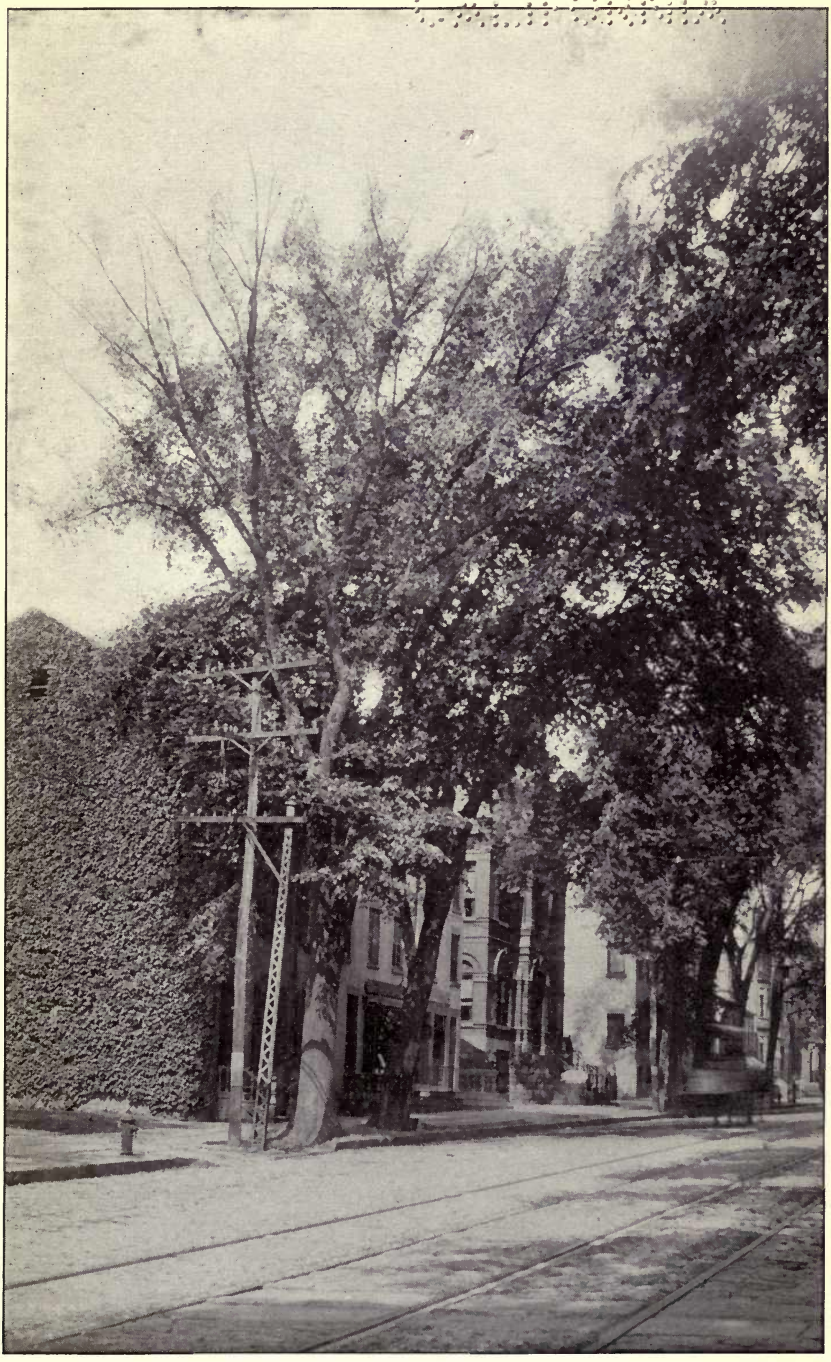
Albany, Aug. 1 ›

Work of elm leaf beetle on South Hawk street

Plate 5

American elm on Washington avenue near Fort Orange Club, Albany, seriously injured by the elm leaf beetle, Galerucella luteola Müll. Photo August 1906. Note the numerous dead limbs. This tree died about two years later.

Plate 5



Albany, Aug. 1906

Work of elm leaf beetle on Washington avenue

Plate 6

Work of white-marked tussock moth, Hemerocampa leucostigma Abb. & Sm., on clump of horse-chestnuts standing on the grounds of St Francis de Sales Asylum, Albany. Photo August 1906.

Plate 6

Albany, Aug. 1906

Work of white-marked tussock moth on horse chestnut

Plate 7

Egg masses of white-marked tussock moth Hemerocampa leucostigma Abb. & Sm., on American elm. Congress street, Albany. Photo August 1906. Note that the egg masses are conspicuous, attached to slight cocoons and therefore easily removed.

Plate 7

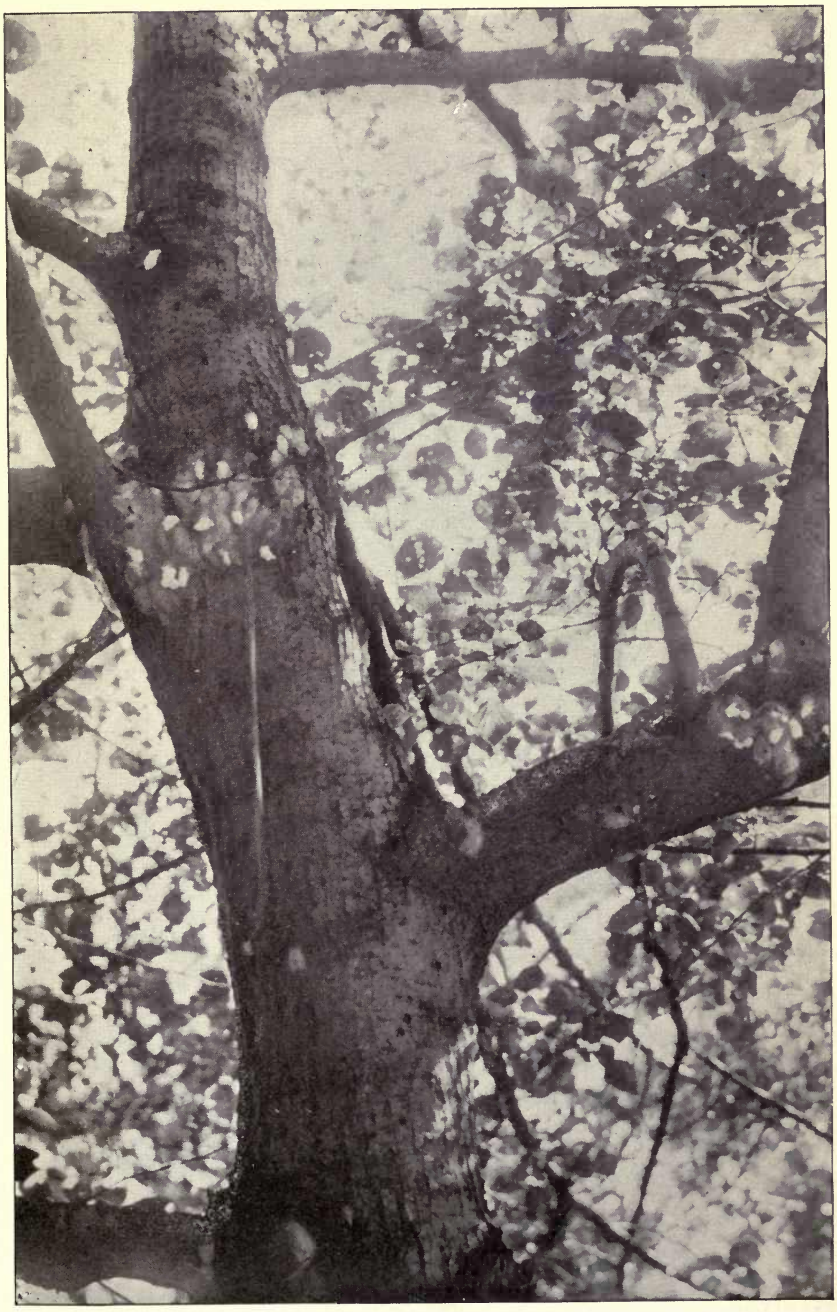
Albany, Aug. 1906

White-marked tussock moth eggs on Spring street

Plate 8

Egg masses of white-marked tussock moth, Hemerocampa leucostigma Abb. & Sm., on English elm, Capitol park, Albany. Photo August 1906. Note that the egg masses are conspicuous, attached to slight cocoons and therefore easily removed.

Plate 8



Capitol Park, Albany, 1906

White-marked tussock moth eggs

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